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## CLAIMS

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[Claim(s)]

[Claim 1] The ink cartridge characterized by leading the ink held in an ink cartridge to a recording head, having the flexible bag which holds ink in the interior of an ink cartridge in the ink cartridge used for the ink jet recording apparatus which carries out the regurgitation of the ink toward a recorded material from the nozzle prepared in this recording head, and having a spring member between the plate-like part material of the pair which has rigidity in the interior of this flexible bag, and the plate-like part material of this pair.

[Claim 2] Said spring member is an ink cartridge according to claim 1 characterized by the adhesion height being a conical spring almost equal to the wire size of this spring member.

[Claim 3] The plate-like part material and spring member of said pair are an ink cartridge according to claim 1 characterized by being formed in one with the same ingredient.

[Claim 4] The ink cartridge according to claim 1 characterized by fixing any first page of said flexible ink bag to an ink cartridge wall.

[Claim 5] The ink jet recording device characterized by air entering in an ink bag in the ink jet recording device which consists of a supply means to connect the ink jet recording head which is made to breathe out ink using an energy conversion object, and records on a recorded material, the ink cartridge equipped with the sealed ink bag, and this ink jet recording head and this ink cartridge when an ink supply pressure reaches the predetermined amount of negative pressure.

[Claim 6] The ink jet recording apparatus characterized by air entering in an ink bag from the at least 1 section of the ink bag which is the flexibility in an ink cartridge in the ink jet recording apparatus of claim 5.

[Claim 7] The ink jet recording device characterized by air entering in an ink bag through an ink supply means from the at least 1 section of a recording head in the ink jet recording device of claim 5.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink cartridge for starting an ink jet recording device, especially carrying out receipt maintenance of the ink, and supplying ink to a recording head.

[0002]

[Description of the Prior Art] Conventionally, the ink supply pressure applied to a recording head in an ink jet recording apparatus (refer to drawing 12 ) by canceling that the positive pressure by engine-performance maintenance of an ink jet recording head and the water head difference of an ink cartridge is applied, and stationing liquid ink Men of an ink cartridge in a low location rather than a delivery for the ink leakage prevention from the delivery of a recording head was maintained to the negative pressure of the specified quantity.

[0003] However, it is difficult in tooth space for there to be constraint of the arrangement location of an ink tank to an ink jet recording head, and to arrange a tank on carriage especially in the recording apparatus of a serial scan mold by this approach, and since the discharge direction of an ink droplet is also restricted, it is impossible to satisfy all the situations of a printing posture. Then, forming a means to generate negative pressure in the ink container itself as a means to solve the above-mentioned constraint is proposed.

[0004] For example, the one approach is shown in JP,56-67269,A, and the cross section of an ink tank has composition as shown in drawing 13 (a), (b), and (c).

[0005] Drawing 13 (a) is the thing of the method with which the thickness of the side attachment wall 52 of an ink tank and the vertical wall 58 differs. Internal pressure adjustment is a method which it is maintained [ method ] by the elastic force of a side attachment wall 52, and a side attachment wall 52 is made [ method ] thinner than the upper low wall of a center section, makes a flat ink tank transform uniformly according to the elastic force of a side attachment wall 52, and makes ink consume.

[0006] Drawing 13 (b) makes the side attachment wall of an ink tank the shape of a bellows 54, and maintains the balance of a pressure by whenever [ elastic / of this bellows section ].

[0007] Drawing 13 (c) arranges the spring material 56 for the uniform thick ink tank 55 inside, and generates negative pressure.

[0008] Drawing 14 forms the ink bag 60 in the interior of the ink tank 59, holds the ink bag 60 on the ink tank 59 with an elastic body 61, and makes the ink outlet 62 generate negative pressure by the pull strength of an elastic body 61.

[0009] However, there were the following troubles in the above-mentioned conventional example.

[0010] Since the negative pressure property of an ink tank will be determined by the thickness of a side attachment wall 52, a configuration, and the quality of the material in drawing 13 (a), Although a side attachment wall 52 needs to be configurations (thickness quality of the material etc.) optimized for a raising-negative pressure property [ of an ink tank ], and ink utilization ratio sake and it is also required to make manufacture dispersion into the minimum It was difficult for a limitation to be especially in respect of thickness and a configuration on a design and manufacture, and to make high improvement in a negative pressure property, and an ink utilization ratio.

[0011] Moreover, although the bellows 54 needed to be optimized since the negative pressure property of an ink tank will be determined by the configurations (thick quality of the material etc.) of a bellows 54 like [ drawing 13 (b) ] drawing 13 (a), raising an ink utilization ratio especially, since a manufacture top's is difficult for configuration equalization (thick equalization) of a bellows 54 and thinning, and negative pressure property stabilization were difficult. Moreover, since the bellows section was not able to be stuck at the time of ink use last, there was a fault that the amount of \*\* ink increased.

[0012] At the time of ink use last, for the structure stuck mostly, if the quality of the material of a tank 55 is made flexible, since it finally sticks a tank 55 mostly, in drawing 13 (c), the amount of \*\* ink can do the spring material 56 few. However, it became difficult to spread the spring force of the spring material 56 over the tank 55 whole at the time of initial ink restoration, since the tank 55 is flexible, and the initial ink fill has decreased extremely. Moreover, in order to make [ many ] an initial ink fill (i.e., in order to spread the spring force of the spring material 56 over the tank 55 whole), a certain amount of rigidity is required for a tank 55, but since a tank 55 stops being crushed easily and it becomes impossible to stick at the time of ink use last if it does so, while negative pressure will increase, the amount of \*\* ink has increased.

[0013] Moreover, the ink in a bag 60 is made to generate negative pressure in drawing 14 according to the spring force of the spring 61 between the ink bag 60 and a tank 59. By this method, a certain amount of die length is needed for a spring 61 in an initial state. Therefore, between the bag 60 and the tank 59, the useless remarkable volume which cannot be filled up with ink existed, and the miniaturization of a tank was difficult.

[0014] And although it is being able to say about all ink containers, we are anxious about the ink of a residual causing environmental pollution in the case of abandonment of an ink container.

[0015]

[Problem(s) to be Solved by the Invention] This invention is made in view of the above troubles, and the purpose generates negative pressure inside a tank with easy structure, and is in the thing with a high ink utilization ratio for which a cheap and small ink cartridge is offered.

[0016] Moreover, this invention is offering an ink jet recording device without the environmental pollution in residual ink by gathering the utilization ratio of ink to about 100% while being able to maintain an ink supply pressure in the predetermined amount of negative pressure so that normal record can be performed.

[0017]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, it sets to this invention. The ink jet recording head which is made to breathe out ink using an energy conversion object, and records on a recorded material, In the ink jet recording device which consists of a supply means to connect the ink cartridge equipped with the sealed ink bag, and this ink jet record \*\*\*\* DO and this ink cartridge By having the flexible bag which holds ink in the interior of an ink cartridge, and putting a spring member between the plate-like part material of the pair which has rigidity in the interior of this flexible bag, and the plate-like part material of this pair The interior of a flexible bag is made to generate negative pressure, and further, when an ink supply pressure reached the predetermined amount of negative pressure, it was made the configuration with which air enters from the exterior in an ink bag.

[0018]

[Function] An ink bag is formed with a flexible material, a spring member is arranged in the meantime [ the plate-like part material of a pair and in the meantime ] which have rigidity in a bag, and the inside of an ink bag is maintained to negative pressure according to the spring force, and the amount of negative pressure of an ink supply pressure increases by ink consumption, it detects having reached the predetermined amount of negative pressure, a hole is broken, and the negative pressure which increased by incorporating air in an ink bag is eased. Consequently, it is eased and the amount of negative pressure of an ink supply pressure can consume almost all ink.

[0019]

[Example] With reference to a drawing, the example of this invention cartridge is explained to a detail below.

[0020] The flexible ink bag with which drawing 1 shows the ink cartridge concerning one example of this invention, and 1 holds ink, 2 has opening for taking out the ink in the ink bag 1, and holds the ink bag 1. A spring member for the joint for sealing and 3 to make the ink bag 1 interior generate negative pressure, The plate-like part material of the pair which has inserted the spring member 3 in order for 4 to make the spring force of the spring member 3 act on the ink bag 1 whole and to hold the spring member 3, An ink cartridge body for a plug for 5 to close ink ejection opening of joint 2 and 6 to hold the ink bag 1 combined with joint 2 and 7 are ink cartridge free wheel plates.

[0021] In the above-mentioned configuration, ink is stored in the flexible ink bag 1, and since this ink needs to break with the open air, as for an ink bag, polyethylene/polyethylene terephthalate, polyethylene / polyvinylidene chloride / nylon polyethylene / nylon, etc. are used for example, from an ink side with a non-permeability ingredient. And as this ink bag 1 is shown in drawing 2, at the time of ink overestimation, the whole volume will become large like a dotted line to the field where the spring force of the spring member 3 does not act. And the spring force of the spring member 3 acts on an ink bag by the plate-like part material of a pair, and negative pressure occurs in ink as it decreases from this condition using ink. And finally the flexible ink bag 1 is crushed and negative pressure becomes rapidly impossible [ the start regurgitation ].

[0022] Therefore, in the above-mentioned configuration, in order to make the spring force fully act on an ink bag and to secure the ink impregnation volume in an ink bag enough further, the plate-like part material 4 of a pair requires that thickness should have thin and sufficient rigidity. For example, an SUS plate, the resin containing a glass fiber, PES, PEEK, etc. are used, as the plate-like part material 4 of the existing pair of this rigidity and the spring member 3 pinched between them show the flexible ink bag 1 to drawing 2, it can form in a rectangular parallelepiped configuration (B) mostly from a flat condition (A), and an ink injection rate can fully be secured.

[0023] And an elastic body, for example, polyurethane foam etc., as shown in the coil spring shown in drawing 4 (a) or drawing 4 (b) as a spring member 3 is used.

[0024] Drawing 3 is drawing showing signs that one pair of plate-like part material 4 and the spring member 3 are contained in the bag 1 of this example, and where the spring member 3 is pinched by the plate-like part material 4 of a pair from opening of a bag 1, it is inserted and contained.

[0025] In drawing 5, it is the cross section of the ink bag 1 in which the suitable structure for raising the utilization ratio of the ink in an ink bag further is shown.

[0026] In this case, the spring member 3 is used as a conical spring, since the adhesion height of a spring is almost equal to the wire size of a spring, as shown in drawing 5 (b), since [ of ink use ] the adhesion height of a spring does not become hindrance but the ink bag 1 can stick mostly at the time of last, the amount of \*\* ink can be reduced, and an ink utilization ratio can be improved.

[0027] Other examples of this invention are explained based on a drawing.

[0028] Drawing 6 shows the case where the spring member between the plate-like part material of the pair in a flexible ink bag and the plate-like part material of this pair forms in one with the same ingredient. Press working of sheet metal of the plate-like part material 8 is carried out like drawing 6 (a) with an SUS plate with rigidity, it is bent like drawing 6 (b), and is held in the flexible bag 1.

[0029] The load rate of this plate-like part material 8 can be determined by changing the thickness  $t$  of the plate-like part material 8, the dimension of width of face 1, and a

bending include angle at this time. That is, the plate-like part material 8 according to the quality of the material of the flexible bag 1, a dimension, etc. can be formed. Since the plate-like part material and spring member of a pair can form by one member according to this method, reduction of components mark and reduction of the number of erectors are achieved, and a large cost cut can be realized.

[0030] Other another examples of this invention are explained based on a drawing.

[0031] Drawing 7 shows the method which fixes one side of the lateral surface of a flexible ink bag to the internal surface of an ink cartridge. As shown in drawing 7 (a), by the plate-like part material 4 of a flexible ink bag, while was able to be extended and the lateral surface and the internal surface of an ink cartridge 6 are being fixed by the glue line 9. As for a glue line 9, adhesive tape, adhesives, etc. are used.

[0032] By this method, the ink cartridge is carried on carriage, for example, and when it reciprocates in the direction of an arrow head A, rocking of the flexible ink bag 1 can be suppressed considerably. Since the space between the flexible ink bags 1 becomes large about an ink cartridge 6 as the ink in the flexible ink bag 1 is consumed especially, the effectiveness of suppressing rocking of the ink bag 1 becomes large.

[0033] Therefore, while preventing the poor regurgitation by rocking of the ink bag 1, damage on the ink bag 1 can also be prevented.

[0034] Moreover, since rocking of the ink bag 1 at the time of conveyance can be suppressed also in a fixed ink cartridge to a printer, the ink leakage by damage on the flexible ink bag 1 can be prevented.

[0035] However, before contraction of an ink bag will not progress, and the negative pressure in an ink bag becomes large gradually and exhausting \*\* ink completely at last since ink follows on being consumed and the rebounding force of the spring member in an ink bag becomes strong when also using the thing of the aforementioned example with an ink jet recording apparatus, supply of ink may stop.

[0036] Then, the example of this invention ink jet recording device is explained further.

[0037] Drawing 8 shows signs that it countered with the platen 100 which a recording head 10 is connected with an ink cartridge 6 by the feed zone material 211, and supports non-illustrated recorded media. A recording head 10 is in the condition which the delivery is prepared in the direction of a platen and requires the positive pressure by the water head difference of an ink cartridge for the delivery section. The making the positive pressure cancel purpose, the ink bag 1 of the ink cartridge 6 interior equips the flexible member 210 interior with the spring member 3. Moreover, the spring member 3 is pinched by the plate 213 with a projection, and the plate 214 with a hole, and it is arranged so that a projection may go into a hole. The flexible member 210 is attached in the opening member 215 equipped with the rubber stopper 217 by means, such as joining, adhesion, and sticking by pressure. And opening is in the flexible member 210 of the location corresponding to the hole of said plate 214 with a hole, and sheet metal 216 is joined so that the opening may be covered.



[0038] Drawing 9 explains about 216 sheet metal structure. (A) is the top view of the ink bag 4, and (B) is an about 216 sheet metal cross-section enlarged drawing. In this example, the flexible member 210 and sheet metal 216 are joined by heat joining. If gas cutoff nature also takes into consideration the quality of the material of the flexible member 210, PE / nylon / PE, PE/aluminum/PE, PE/PET/PE, PE / Eval \* / PE, PE / vinylidene chloride / PE, etc. are raised, and 30 micrometers or less of each class are suitable (Eval: trademark [ of ethylene vinyl alcohol copolymerization resin ]; Kuraray Co., Ltd.). That in which the quality of the material of sheet metal 216 has stability, such as PE/PET (100 micrometers) and PE/SUS (100 micrometers), from a flexible member side is suitable.

[0039] sheet metal 216 should carry out joining to the flexible member 210 -- the narrow part is prepared like a large part and 216b like \*\* and 216a of (A).

[0040] Drawing 10 explains actuation. (a) shows an initial state, the plate 213 with a projection and the plate 214 with a hole are separated, and heat joining of the flexible member 210 and the sheet metal 216 is carried out. Although the spring member 3 is compressed by the atmospheric pressure with consumption of ink, the negative pressure in an ink stores dept. becomes high. And when it changes into the (b) condition, sheet metal 216 is made to separate from the flexible member 210 by the projection of the plate 213 with a projection. The separating location serves as 216weak b sections of the junction force, and sheet metal 216 has the property of a flat spring in which 216a sections were fixed. Moreover, at this time, air enters in an ink bag from the exfoliation section of sheet metal 216, and the spring member 3 reverts like the (c) condition. Consequently, negative pressure is eased. (c) Sheet metal 216 and the flexible member 210 are close in a condition, and don't generate ink leakage by the meniscus holding power of ink in the meantime. Liquid ink Men of the (c) condition is lower than the air incorporation section (exfoliation section of sheet metal 216), and the air incorporation section is always however, satisfactory also in the state of an atmospheric-air free passage in the case of the location below equivalent on the engine performance to a recording head 10 after the (b) condition.

[0041] Other examples of this invention ink jet recording device are explained.

[0042] Drawing 11 shows signs that it countered with the platen 100 to which the feed zone material 211 connects with and the recording head 1 which has the first nozzle 60 which carries out the regurgitation of the ink for recording as an ink cartridge 6 supports non-illustrated recorded media. The condition that the positive pressure by the water head difference of an ink cartridge and a recording head is applied to the delivery section of a recording head 10 is shown. The making the positive pressure cancel purpose, the ink bag 1 of the ink cartridge 3 interior equips the flexible member 210 interior with the spring member 3. The flexible member 210 is attached in the opening member 215 equipped with the rubber stopper 217 by means, such as joining, adhesion, and sticking by pressure. In the recording head 10, it has the second nozzle 61 other than the first nozzle 60. The second nozzle 61 is connected with the ink bag 1 with the pipe 212. The second nozzle 61 is formed so that the cross section may be large and the meniscus holding power of the second nozzle 61 may become equal to Pmax from the first nozzle 60.

[0043] Actuation is explained.

[0044] The spring member 3 is compressed with consumption of ink, when the negative pressure in an ink bag becomes high and becomes more than  $P_{max}$ , the meniscus of the second nozzle 61 is torn, and air is incorporated in an ink bag. By this, the spring member 3 reverts, negative pressure is eased, and a meniscus is formed when it becomes below  $P_{max}$ . Almost all ink can be consumed by repeating the above actuation.

[0045]

[Effect of the Invention] As the detail was carried out above, according to this invention In order that the spring force may act on the flexible whole bag at homogeneity with the spring which exists between them [ the plate of a pair and between them ] with the rigidity inside [ in which the ink in an ink cartridge is held ] a flexible bag, an initial ink fill can secure enough, and generates and maintains negative pressure required for an ink jet recording device. An initial ink fill, The structure where dependability with the negative pressure property which solved the problem of the amount of \*\* ink and was excellent is high is easy, and can offer a cheap and small ink cartridge with a high ink utilization ratio.

[0046] Furthermore, when an ink supply pressure reached the predetermined amount of negative pressure in this invention, while being able to perform normal record by having made it the configuration which air starts in an ink bag, it became possible to gather the utilization ratio of ink to about 100%. Consequently, the ink jet recording device without the environmental pollution in residual ink was able to be offered.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] The perspective view showing the example of this invention ink cartridge

[Drawing 2] The sectional view showing the configuration of the ink bag which carried out this invention

[Drawing 3] The perspective view showing the configuration of the ink bag which carried out this invention

[Drawing 4] The sectional view showing one example of the ink bag of this invention

[Drawing 5] The sectional view showing other examples of the ink bag of this invention

[Drawing 6] The sectional view showing other examples of the ink bag of this invention

[Drawing 7] The sectional view showing other examples of the ink bag of this invention

[Drawing 8] The schematic diagram of the 1st example of this invention ink jet recording device

[Drawing 9] Detail drawing of the 1st example of this invention ink jet recording device

[Drawing 10] The sectional view showing actuation of the 1st example of this invention ink jet recording device

[Drawing 11] The schematic diagram of the 2nd example of this invention ink jet recording device

[Drawing 12] The schematic diagram showing the conventional ink jet recording device

[Drawing 13] The sectional view showing the ink tank of the conventional example

[Drawing 14] The sectional view showing the ink tank of other examples of the conventional example

### [Description of Notations]

1 Flexible Ink Bag

2 Joint

3 Spring Member

4 Plate-like Part Material

5 Plug

6 Ink Cartridge Body  
7 Ink Cartridge Free Wheel Plate  
8 Plate-like Part Material  
9 Glue Line  
10 Ink Jet Recording Head  
12 Pipe  
15 Opening Member  
16 Sheet Metal  
52 Side Attachment Wall  
53 Vertical Wall  
54 Bellows  
55 Ink Tank  
56 Elastic Material  
59 Ink Tank  
60 Ink Bag  
61 Elastic Body  
62 Ink Outlet  
210 Flexible Member  
211 Feed Zone Material  
212 Pipe  
213 Plate with Projection  
214 Plate with Hole  
215 Opening Member  
216 Sheet Metal

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